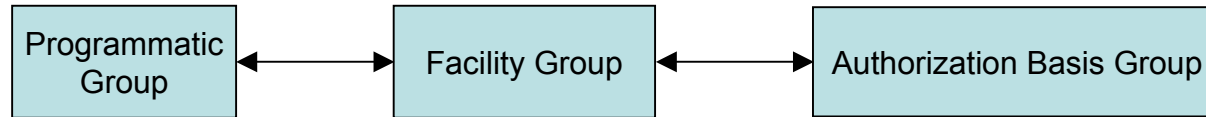


# **Nuclear Facility Category I Design Features for Safe Programmatic Operations**

- **0.3 micron filters for gas sampling lines leaving glove boxes (99.997% particulate removal)**
- **Electrical feed-thrus for automated data acquisition (temperature, pressure, corrosion sensor, solenoid valves)**
- **Filtration between equipment exhaust (vacuum pumps, GC, MS) and facility exhaust**
- **Pressure relief devices to prevent over-pressurization**
- **Minimization of compression fittings (maximization of welded lines)**
- **Remote operations when large quantities of PuO<sub>2</sub> involved**
- **Laser enclosures and fiber optics for operation of Class 1 laser**
- **Fiber optic feed-thrus for glove box interface & remote data acquisition for Raman spectroscopy**

# Engineering Process for Changes to Safety Significant Feature in a Category I Nuclear Facility

*Requires team work with multiple organizations for a successful project*



- Programmatic Group prepares a Design Summary then obtains a Design Change Package number (DCP#) from Facility Group.
- Programmatic & Facility Engineers conduct a scoping meeting to identify design criteria.
- Programmatic Group identifies, mitigates and documents Process Hazards and develops design drawings to Laboratory Standards.
- DCP undergoes a 30/60/90/100% Design Review.
- The DCP package is forwarded to Authorization Basis Group for an Un-reviewed Safety Question (USQ) and Hazards Analysis (HA). Once complete, the package is returned to the Facility Group.
- Facility Group performs final review and authorizes/oversees the release of the DCP for implementation of design process.
- Construction/Post-Modification Testing are completed.
- Final package is inspected, closed-out and authorization is obtained for operation.

# Monitoring system for PuO<sub>2</sub> containers requires specialized glove box interfaces

- Gas samples drawn for analysis by gas chromatograph and mass spectroscopy.
- Raman spectra can be taken inside the container using fiber optics.
- All instrumentation is outside of the glove box line.
- Pressure and temperature continuously monitored.



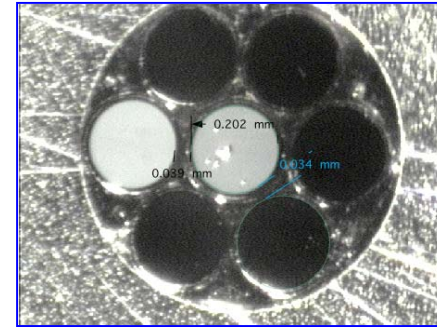
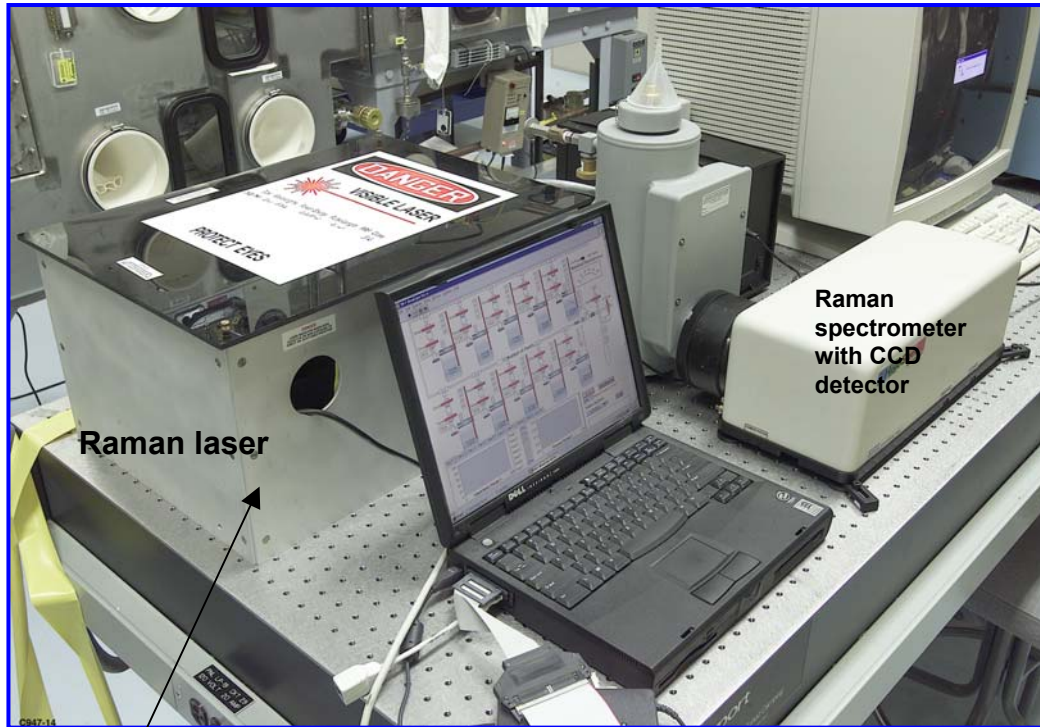
# Engineering design features allow for safe sampling of gases inside $\text{PuO}_2$ containers.

- Gas sample removal requires HEPA filtration (contamination control),
- Heating of sample line (quantitative analysis of gases),
- Pressure monitoring, check valves, pressure regulators,
- Electrical feed-thrus for data acquisition (temperature, pressure, corrosion sensor)



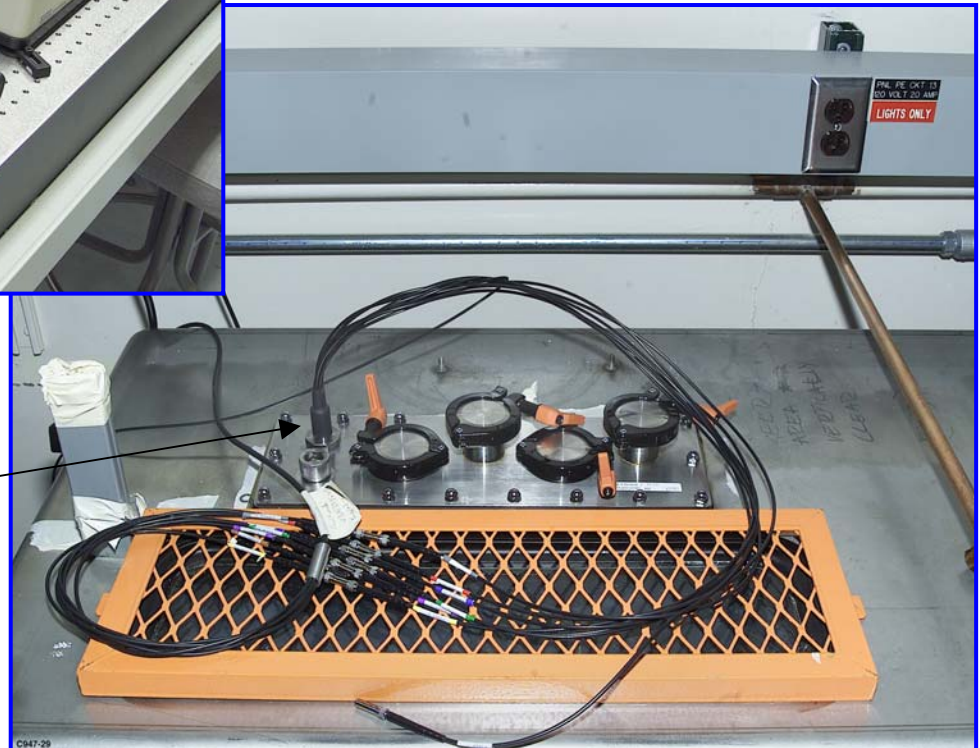


# Raman and Data Acquisition Systems

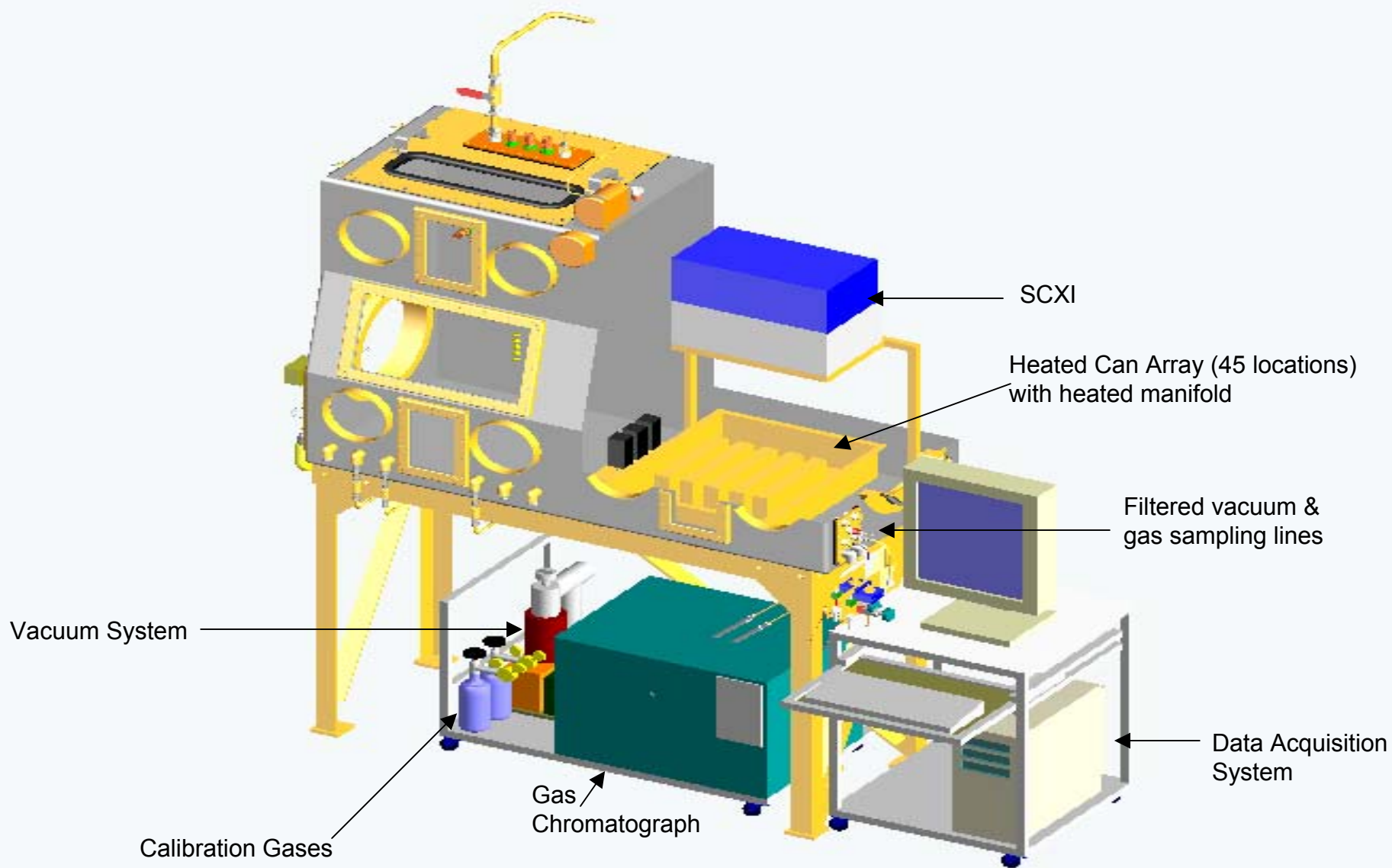


2 mm multi mode Raman fibers; 10 m long; 6 around 1 bundle

- Laser enclosure allows for Class 1 laser operation
- Raman system includes fiber optic feed-thrus
- Computer interface / data acquisition allows for remote gas sampling (reduces radiation exposure)



# Small-Scale Study Glove Box Assembly Cut Away View

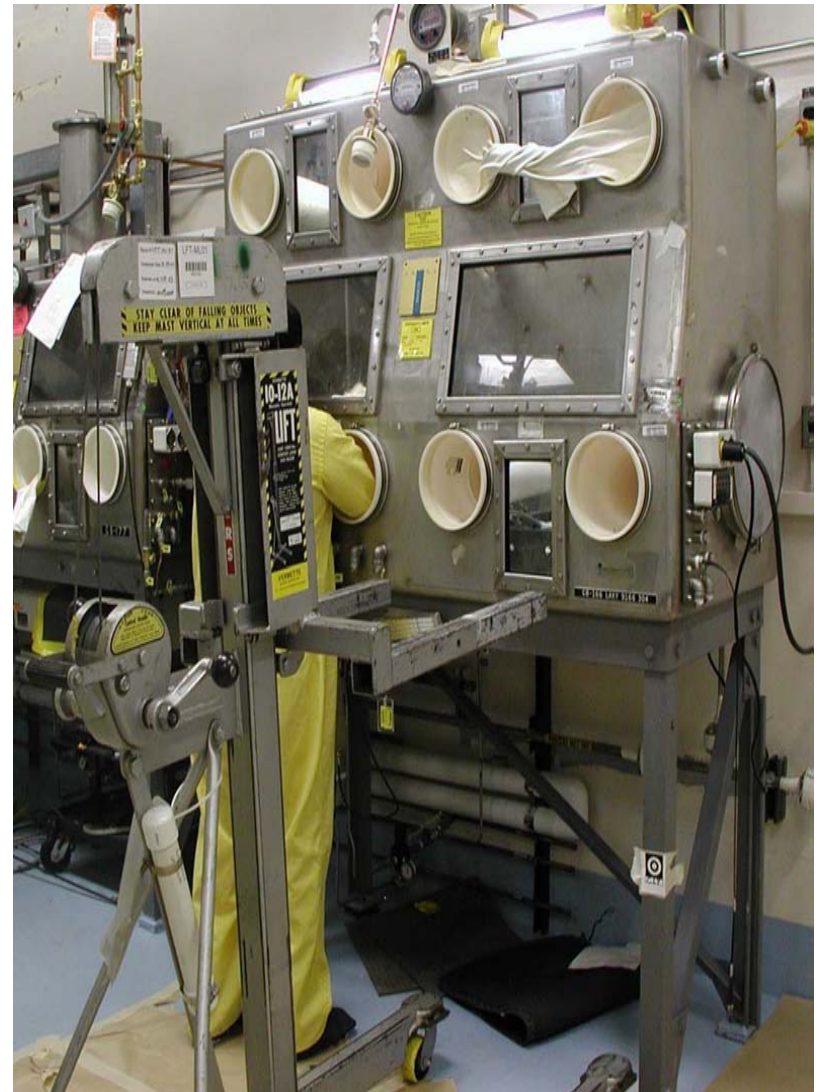




# Small-Scale equipment introduced into a Pu glove box

## 9/12/02

- **Introduction thru a glove box window change**
  - Radioactive hot job (respirators, extra PPE),
  - Special permits
  - Pre-job discussions (SD-HCP & RWP)
  - Non-rad. practice
- **Challenges**
  - Heavy equipment (70lb) with ~1/2 inch clearance
  - Delicate wiring and gas manifold plumbing
  - Glove box opened to room for brief period (<2 minutes)
  - Multiple trained and experienced personnel required



# Summary

- **Unique design requirements for sealed Pu containers.**
- **Complex infrastructure required for surveillance of Plutonium oxide materials in a Cat.I Nuclear Facility.**
- **Engineering Process is comprehensive for glove box modifications and new activities.**
- **Multiple gas analysis techniques for the large scale study are performing as designed and data collection is continuous.**
- **Safe installation of small scale heated container array into a glove box has been completed.**
- **Glove box modifications for the small scale study are pending the completion of the engineering review process.**